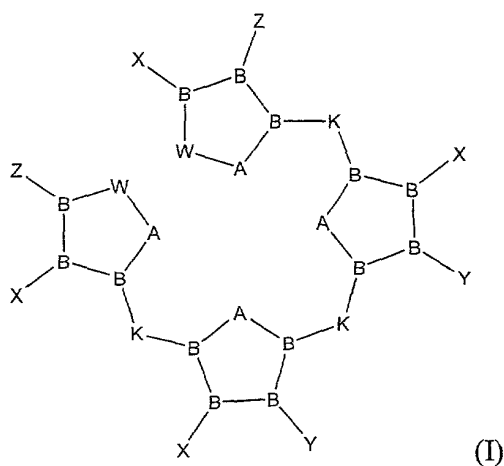


We claim:

1. A method for modulating cell proliferation or cell differentiation, comprising treating a cell with a bilin.
2. A method for regulating cell proliferation, comprising treating a cell with a bilin represented by the general formula (I):



wherein W, independently for each occurrence, represents $-\text{CL}_2-$, $-\text{C}(=\text{O})-$, $-\text{C}(=\text{S})-$, $-\text{C}(=\text{NH})-$, or $=\text{CL}-$;

X, independently for each occurrence, represents a substituted or unsubstituted alkyl, alkenyl, or alkynyl group;

Y, independently for each occurrence, represents a substituted or unsubstituted alkyl, alkenyl, or alkynyl group;

Z, independently for each occurrence, represents a substituted or unsubstituted alkyl, alkenyl, or alkynyl group;

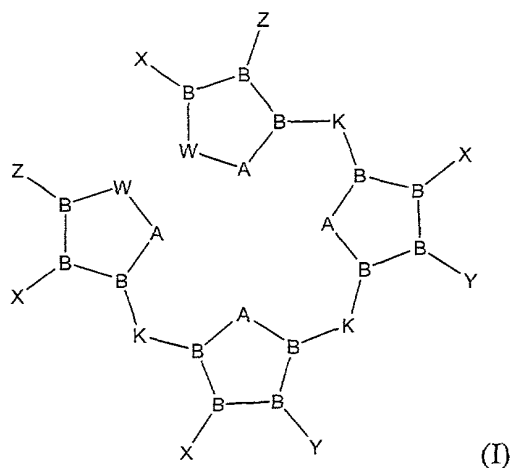
A, independently for each occurrence, represents $-\text{NH}-$ or $-\text{N}=-$;

B, independently for each occurrence, represents a trisubstituted, sp^2 -hybridized carbon atom;

K, independently for each occurrence, represents $=\text{CL}-$ or $-\text{CL}_2-$; and

L, independently for each occurrence, represents H or lower alkyl.

3. The method of claim 2, wherein the bilin regulates cell proliferation with an ED₅₀ of 1 mM or less.
4. The method of claim 2, wherein the bilin regulates cell proliferation with an ED₅₀ of 1 μM or less.
5. The method of claim 2, wherein the bilin regulates cell proliferation with an ED₅₀ of 1 nM or less.
6. The method of claim 2, wherein the cell is contacted with the bilin *in vitro*.
7. The method of claim 2, wherein the cell is contacted with the bilin *in vivo*.
8. The method of claim 7, wherein the bilin is administered as part of a therapeutic or cosmetic application.
9. The method of claim 8, wherein the therapeutic or cosmetic application is selected from regulation of neural tissues, bone and cartilage formation and repair, regulation of spermatogenesis, regulation of smooth muscle, regulation of lung, liver and other organs arising from the primitive gut, regulation of hematopoietic function, regulation of skin and hair growth, etc.
10. A method for regulating differentiation of a cell, comprising treating a cell with a bilin represented by the general formula (I):



wherein W, independently for each occurrence, represents $-\text{CL}_2-$, $-\text{C}(=\text{O})-$, $-\text{C}(=\text{S})-$, $-\text{C}(=\text{NH})-$, or $=\text{CL}-$;

5 X, independently for each occurrence, represents a substituted or unsubstituted alkyl, alkenyl, or alkynyl group;

Y, independently for each occurrence, represents a substituted or unsubstituted alkyl, alkenyl, or alkynyl group;

10 Z, independently for each occurrence, represents a substituted or unsubstituted alkyl, alkenyl, or alkynyl group;

A, independently for each occurrence, represents $-\text{NH}-$ or $-\text{N}=-$;

B, independently for each occurrence, represents a trisubstituted, sp^2 -hybridized carbon atom;

K, independently for each occurrence, represents $=\text{CL}-$ or $-\text{CL}_2-$; and

15 L, independently for each occurrence, represents H or lower alkyl.

11. The method of claim 10, wherein the bilin promotes cell differentiation with an ED_{50} of 1 mM or less.

20 12. The method of claim 10, wherein the bilin promotes cell differentiation with an ED_{50} of 1 μM or less.

13. The method of claim 10, wherein the bilin promotes cell differentiation with an ED₅₀ of 1 nM or less.

14. The method of claim 10, wherein the cell is contacted with the bilin *in vitro*.

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15. The method of claim 10, wherein the cell is contacted with the bilin *in vivo*.

16. The method of claim 15, wherein the bilin is administered as part of a therapeutic or cosmetic application.

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17. The method of claim 16, wherein the therapeutic or cosmetic application is selected from regulation of neural tissues, bone and cartilage formation and repair, regulation of spermatogenesis, regulation of smooth muscle, regulation of lung, liver and other organs arising from the primitive gut, regulation of hematopoietic function, regulation of skin and hair growth, etc.

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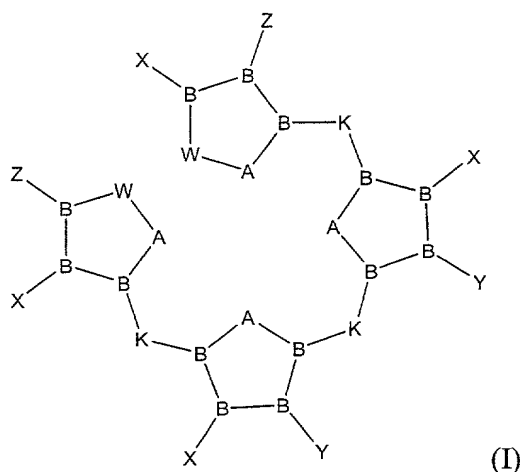
18. The method of claim 10, wherein at least one occurrence of Y includes a carboxyl group.

20

19. A pharmaceutical preparation comprising a sterile pharmaceutical excipient and a bilin.

20. A pharmaceutical preparation comprising a sterile pharmaceutical excipient and a bilin represented by the general formula (I):

25



(I)

wherein W, independently for each occurrence, represents $-\text{CL}_2-$, $-\text{C}(=\text{O})-$, $-\text{C}(=\text{S})-$, $-\text{C}(=\text{NH})-$, or $=\text{CL}-$;

5 X, independently for each occurrence, represents a substituted or unsubstituted alkyl, alkenyl, or alkynyl group;

Y, independently for each occurrence, represents a substituted or unsubstituted alkyl, alkenyl, or alkynyl group;

10 Z, independently for each occurrence, represents a substituted or unsubstituted alkyl, alkenyl, or alkynyl group;

A, independently for each occurrence, represents $-\text{NH}-$ or $-\text{N}=\text{}$;

B, independently for each occurrence, represents a trisubstituted, sp^2 -hybridized carbon atom;

K, independently for each occurrence, represents $=\text{CL}-$ or $-\text{CL}_2-$; and

15 L, independently for each occurrence, represents H or lower alkyl.

21. The preparation of claim 20, wherein at least one occurrence of Y includes a carboxyl group.

20 22. A method for treating unwanted cell proliferation, comprising administering to a patient the pharmaceutical preparation of claim 18.

23. The method of claim 1, wherein the bilin is bilirubin or biliverdine.

24. The method of claim 2, wherein the bilin is bilirubin or biliverdine.
25. The method of claim 10, wherein the bilin is bilirubin or biliverdine.
- 5 26. The preparation of claim 18, wherein the bilin is bilirubin or biliverdine.
27. A method for modulating cell proliferation or cell differentiation, comprising treating a cell with a compound which binds to an aryl hydrocarbon receptor.
- 10 28. The method of claim 27, wherein the compound regulates cell proliferation with an ED₅₀ of 1 mM or less.
29. The method of claim 27, wherein the compound regulates cell proliferation with an ED₅₀ of 1 μM or less.
- 15 30. The method of claim 27, wherein the compound regulates cell proliferation with an ED₅₀ of 1 nM or less.
31. The method of claim 27, wherein the cell is contacted with the compound *in vitro*.
- 20 32. The method of claim 27, wherein the cell is contacted with the compound *in vivo*.
33. The method of claim 32, wherein the compound is administered as part of a therapeutic or cosmetic application.
- 25 34. The method of claim 33, wherein the therapeutic or cosmetic application is selected from regulation of neural tissues, bone and cartilage formation and repair, regulation of spermatogenesis, regulation of smooth muscle, regulation of lung,

liver and other organs arising from the primitive gut, regulation of hematopoietic function, regulation of skin and hair growth, etc.

- 5 35. A method for regulating differentiation of a cell, comprising treating a cell with a compound which binds to an aryl hydrocarbon receptor.
36. The method of claim 35, wherein the compound promotes cell differentiation with an ED₅₀ of 1 mM or less.
- 10 37. The method of claim 35, wherein the compound promotes cell differentiation with an ED₅₀ of 1 μ M or less.
38. The method of claim 35, wherein the compound promotes cell differentiation with an ED₅₀ of 1 nM or less.
- 15 39. The method of claim 35, wherein the cell is contacted with the compound *in vitro*.
40. The method of claim 35, wherein the cell is contacted with the compound *in vivo*.
- 20 41. The method of claim 40, wherein the compound is administered as part of a therapeutic or cosmetic application.
- 25 42. The method of claim 41, wherein the therapeutic or cosmetic application is selected from regulation of neural tissues, bone and cartilage formation and repair, regulation of spermatogenesis, regulation of smooth muscle, regulation of lung, liver and other organs arising from the primitive gut, regulation of hematopoietic function, regulation of skin and hair growth, etc.

- [illegible]